

Remarks/Arguments

The Examiner is thanked for the careful review of this application. Claims 26-49 are pending after entry of the present Amendment. Claims 1-25 have been cancelled. It is respectfully submitted that amendments do not introduce new matter.

Rejections under 35 U.S.C. § 103:

The Applicants submit that new claims 26-49 are patentable under 35 U.S.C. § 103(a) over any combination of the cited prior art for at least the following reasons. For instance, in independent claim 26, the second etchant gas is defined to include a combination of O₂, HBr, and SF₆, in independent claim 33, the first etchant gas is defined to include a combination of CF₄, CH₂F₂, and O₂, and in independent claim 40 four different combinations have been defined, the first etchant gas can be defined to include a combination of C₂F₆, CH₂F₂, and O₂ and the second etchant gas can be defined to include a combination of O₂, HBr, and SF₆, the first etchant gas can be defined to include a combination of CF₄, CH₂F₂, and O₂ and the second etchant gas can be defined to include a combination of O₂, HBr, and SF₆, the first etchant gas can be defined to include a combination of CF₄, HBr, and O₂ and the second etchant gas can be defined to include a combination of C₂F₆, CH₂F₂, and O₂, or the first etchant gas can be defined to include a combination of CF₄, HBr, O₂ and the second etchant gas can be defined to include a combination of O₂, HBr, and SF₆.

For instance, the second etchant composition, as defined in new independent claims 26, 33, and 39 does not have the same properties as the etchant gas composition taught in Armacost. Specifically, in the claimed invention, the second etchant gas can include either a combination of O₂, HBr, and SF₆ or a combination of C₂F₆, CH₂F₂, and O₂. Armacost, however, fails to disclose, teach, or suggest the combination of O₂, HBr, and SF₆. Furthermore, in the claimed invention, the percentage by volume of CH₂F₂ is defined to range between approximately 37% and 58%, whereas the percentage by volume of CH₂F₂ in Armacost is taught to be between 10%-30% (the Applicants respectfully submit that one of ordinary skill in the art can easily calculate the percentage by volume of C₂F₆, CH₂F₂, and O₂ using the flow rates of C₂F₆, CH₂F₂, and O₂ provided as the more preferred range of C₂F₆, CH₂F₂, and O₂ by the Applicants in Table 5 of the subject application).

Additionally, the latter combination of gases, and more specifically the CH₂F₂, is used in Armacost to increase photoresist selectivity, to enhance isotropic etching of the silicon nitride in high aspect ratio areas, and to avoid subsequent loss of image integrity. Particularly,

Armacost focuses on using the composition to avoid loss of image integrity caused in high aspect ratio areas caused by excess photoresist erosion. Armacost is further directed at etching features in a silicon nitride layer covered by photoresist material as opposed to removing the nitride layer from over the substrate surface (e.g., etching a layer not covered by photoresist material). Nguyen, Yu, and Chiu, however, are not directed at minimizing photoresist erosion or avoiding loss of image integrity associated with photoresist erosion. Rather, Nguyen teaches etching a layer of silicon nitride using the etching recipe comprising of He, SF₆, and HBr; Chiu teaches using a two step plasma etch operation to remove a gate electrode layer from over a gate dielectric layer using a second etchant gas that includes chlorine; and Yu teaches employing a two-step etch process using etchant gases including chlorine, helium, and HBr. Thus, even if the composition of Armacost had the same properties of the second etchant gas of the claimed invention (e.g., included the same percentage by volume of the CH₂F₂ gas, a proposition with which the Applicants disagree), Armacost fails to suggest using Armacost's composition to form silicon nitride spacers by etching a silicon nitride layer not covered by photoresist material as implemented in Nguyen or Yu. Thus, the combinations of Nguyen and Chiu or Yu and Chiu do not teach, disclose, or suggest etching the thin silicon nitride layer using a composition that is selected by Armacost for the specific property of having high selectivity to photoresist when the silicon nitride layer being etched is not covered by photoresist material.

Yet further, it must be noted that if the composition of Armacost were to substitute the etchant gas compositions used in combination of Nguyen and Chiu, or Yu and Chiu, the silicon nitride layer is etched isotropically, as taught by Armacost. As a result, implementing the composition of Armacost prevents the formation of silicon nitride spacers in Nguyen and Yu, rendering the cited prior art unsatisfactory for respective intended purpose of forming spacers.

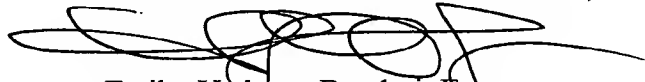
Still further, the Applicants submit that substituting the first and second etching recipes of Nguyen that include He, the first and second etchant gases of Chiu that include chlorine containing etchant gas compositions, and the etchant gases of Yu that include He, Cl, and HBr changes the principle of operation of the cited prior art. Specifically, Nguyen and Yu have to be substantially reconstructed to use Armacost's composition. For instance, Nguyen discloses two objectives for using He in the etchant gases. First, the helium is used to provide more uniform etching results. Second, the helium is used as the helium makes endpoint detection easier by making the peak seen in the optical spectrometer more pronounced.

However, Armacost fails to teach, disclose, or suggest that the composition taught by Armacost can provide a more uniform etching results. Nor does Armacost teach, disclose, or suggest that its composition, when used, can make endpoint detection easier by making the peak seen easier or that the more is the quantity of any of the gases in the composition, the easier it is in Armacost to deduce that the silicon nitride layer has been removed. Accordingly, to use the composition of Armacost in Nguyen, Yu, or Chiu, the principle construction of Nguyen and Chiu has to be modified to accommodate detection of endpoint without the presence of helium or chlorine. Additionally, one must note that Armacost fails to teach implementing a specific type of etch endpoint detection that may be used to detect etch endpoint when using Armacost's composition.

Therefore, it is respectfully submitted that independent claims 26, 33, and 39 are patentable under 35 U.S.C. § 103(a) over any combination of the cited prior art. In a like manner, dependent claims 27-32, 34-38, and 40-43 which incorporate each and every element of the applicable independent claim are patentable under 35 U.S.C. § 103(a) over any combination of the cited prior art for at least the same reasons discussed above.

In view of the foregoing, the Applicants respectfully submit that all of the pending claims 26-43 are in condition for allowance. Accordingly, a Notice of Allowance is respectfully requested. If the Examiner has any questions concerning the present Amendment, the Examiner is kindly requested to contact the undersigned at (408) 774-6913. If any additional fees are due in connection with filing this Amendment, the Commissioner is also authorized to charge Deposit Account No. 50-0805 (Order No. LAM2P295). A duplicate copy of the transmittal is enclosed for this purpose.

Respectfully submitted,
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